

**REVIEW OF VARIATION IN *ACRODIPSAS CUPREA* (SANDS, 1965)
AND *A. AURATA* SANDS, 1997 (LEPIDOPTERA: LYCAENIDAE),
WITH DESCRIPTIONS OF A NEW SUBSPECIES OF *A. CUPREA*
AND A NEW SPECIES OF *ACRODIPSAS* SANDS FROM INLAND
SOUTHERN QUEENSLAND**

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Abstract

Variation in *Acrodipsas cuprea* (Sands, 1965) and *A. aurata* Sands, 1997, both part of the *cuprea* species-complex, is reviewed. A new subspecies, *A. cuprea variabilis* subsp. n., from northern New South Wales and southeastern Queensland, is described and compared with nominotypical *A. cuprea cuprea* found from subcoastal New South Wales to Victoria. *Acrodipsas violacea* sp. n., a closely related species from southern inland Queensland, is described, figured and assigned to the *myrmecophila* species-group on the basis of morphology of the femora of both sexes.

Introduction

The genus *Acrodipsas* Sands, 1980 is a group of morphologically similar Lycaenidae assigned to the Tribe Luciini (Edwards 1996). All species are restricted to the Australian mainland. Little is known of their biology but evidence suggests that the larvae are predatory on immature stages of ants (Common and Waterhouse 1972, Samson 1989). Adult females emerge from the pupa with almost fully mature eggs (Sands 1979), unusual for Australian Lycaenidae. Two species-groups were recognised by Miller and Edwards (1978) and Sands (1979): the *myrmecophila* species-group, in which the adult legs are unmodified, and the *illidgei* species-group, in which the fore and hind femora are swollen and the mid tibia is greatly reduced. Geographical variation in *Acrodipsas cuprea* (Sands), a member of the *myrmecophila* species-group, was noted when the species was first described (Sands 1965). Many species are difficult to distinguish because of the rarity of the females and because of variation in the colour of adults, in this case of *A. cuprea* (Common and Waterhouse 1972, Sands 1979, 1997, Braby 2000, Eastwood and Hughes 2003a, Orr and Kitching 2010). Similar species, including *A. cuprea* and *A. aurata* Sands, are referred here to a ‘*cuprea* species-complex’.

Variation in males of *A. cuprea* includes distinct, obscure or absent coppery scaling of basal areas on the upperside of the forewings, or presence or absence of blue scales on the upperside of both wings (Braby 2000, Orr and Kitching 2010). Braby (2010) and Field (2013) referred to these males as copper, brown or blue ‘forms’ of *A. cuprea*. Variation in the extent of blue scaling on the upperside of females of *A. cuprea* and *A. aurata* is also considerable and in *A. aurata* the presence and extent of blue scaling may be seasonal (Sands 1997). Eastwood and Hughes (2003a) studied the DNA of mounted specimens from various populations and referred to the different forms as morphotypes. They also examined the phylogenetic relationships of

Acrodipsas spp., based on the study on DNA samples from dried museum specimens, and grouped the differing populations according to their molecular similarity (Eastwood and Hughes 2003b).

In this paper we discuss variation in the *cuprea* species-complex, including *A. aurata*, and revise the taxonomic identities of the previously recognised forms of *A. cuprea*. We describe the variable subspecies *A. cuprea variabilis* subsp. n. from northern New South Wales, coastal southeastern Queensland and the main Dividing Range from the New South Wales border to the Blackdown Tableland, Qld. We also describe and figure the new species *Acrodipsas violacea* sp. n. from inland southern Queensland and compare it with *A. cuprea variabilis*.

Abbreviations: AMS – Australian Museum, Sydney; ANIC – Australian National Insect Collection, CSIRO, Canberra; MCS – collection of Michael Sands, Brisbane; NMV – National Museum of Victoria; QM – Queensland Museum, Brisbane; RM – collection of Russell Mayo, Pomona, Queensland.

***Acrodipsas cuprea cuprea* (Sands)**

(Figs 1-8)

Pseudodipsas cuprea Sands, 1965: 69-71. Holotype ♂, New South Wales: Toronto, in AMS.

Acrodipsas cuprea (Sands): Sands 1979: 251-265.

Acrodipsas cuprea (Sands) copper form: Braby 2000 (Plate 43: 6a), Field 2013, Eastwood and Hughes 2003a.

Diagnosis. The uppersides of males of the southern subspecies, *A. cuprea cuprea*, are distinguished from other *Acrodipsas* species, including *A. brisbanensis* (Miskin) and *A. cuprea variabilis* subsp. n., by the well defined subtriangular coppery base to the forewings and the position of the postmedian bands on the underside of the forewings. The forewings are more strongly bowed than those of *A. c. variabilis*. On the underside of the forewings of both sexes, the postmedian bands are aligned or only slightly displaced at M₃ and CuA₂ in *A. c. cuprea* and *A. c. variabilis*, a useful characteristic for separating the southern subspecies *A. c. cuprea* from *A. brisbanensis*, in which there is strong displacement. Above, the upperside of both wings of females of *A. c. cuprea* are grey-black or black, with variable basal and subbasal areas of dark blue usually reaching the cells but not extending to the tornus of the hindwing. Females of *A. c. cuprea* are very similar to females of *A. c. variabilis* but the forewings of *A. c. variabilis* are usually broader and the areas of blue on the upperside are more extensive.

Variation. Males of *A. c. cuprea* can be distinguished from those of *A. c. variabilis* by the subtriangular coppery basal area of the forewings. This coppery area is well defined in *A. c. cuprea* but may vary in brightness and, in specimens from north of Newcastle, NSW, the area may be less well defined than in specimens from southeastern NSW and Victoria.



Figs 1-8. *Acrodipsas cuprea cuprea* (Sands): (1, 3) ♂♂ uppersides; (5, 7) ♂♂ undersides; (2, 4, 6) ♀♀ uppersides; (8) ♀ underside. Localities: (1) Stanwell Park, NSW; (2) Moe, Victoria; (3, 7) Newcastle, NSW; (4, 6, 8) Port Stephens, NSW; (5) Narara, NSW.

Males from between Boambee and Port Macquarie, NSW, have the basal coppery suffusions less clearly defined, whereas in males from Stanwell Park and Pambula, NSW, the coppery areas are clearly developed. The blue areas on the forewings of *A. c. cuprea* females are somewhat variable and may be restricted to the subbasal region of both wings or extend into the cell. The male genitalia of *A. c. cuprea* differ only slightly from those of *A. c. variabilis*, the valvae of the latter being slightly more slender apically and the apical fold slightly narrower than that of *A. c. cuprea*, but not as narrow as in *A. violacea*.

Distribution. Victoria: Western Gippsland and Warragul to the NSW-Victoria border (Field 2013); New South Wales: southeastern coastal and subcoastal ranges from Pambula to Boambee south of Coffs Harbour, westwards from the Hunter Valley to Denman and the main Dividing Range south of Ebor.

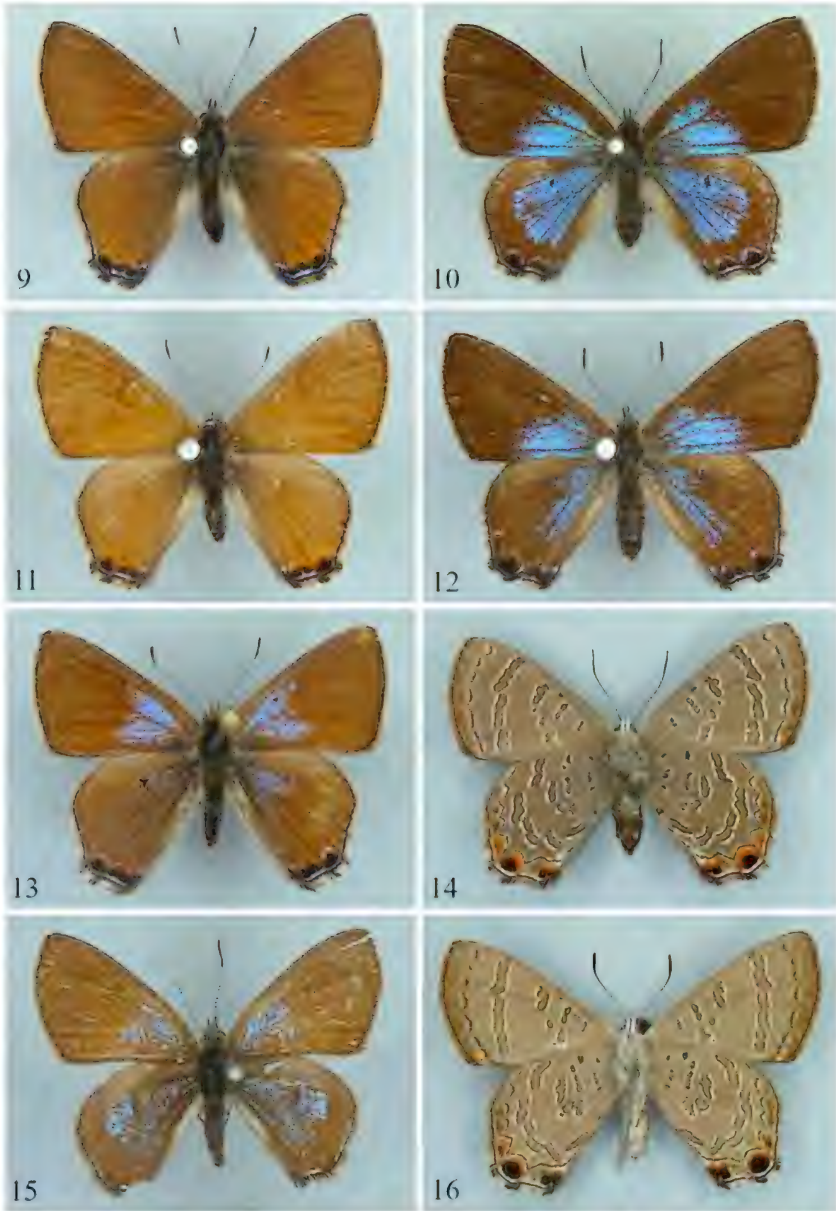
Biology. Immature stages are associated with the ant genus *Crematogaster* Lund and larvae are probably predatory on the immature stages of these ants (Braby 2000, Field 2013). Eggs of *A. c. cuprea* (figured by Field 2013) are similar to those of *A. myrmecophila* (Waterhouse & Lyell) (Sands 1979) and are said to be carried by ants into their nests (Field 2013). At Newport, NSW, *Crematogaster* sp. ants were seen tending eggs (Sands 1997) before carrying newly-hatched larvae into a hollow branch of a mature *Acacia implexa* Benth., already occupied by larvae of *Hypochrysops delicia delicia* Hewitson. In Victoria, 17 specimens of *A. c. cuprea* (initially thought to be *A. brisbanensis*) were reared from nests of *Crematogaster* sp. in senescing hollow branches of an *Acacia baileyana* (Field 1978 and L. Gooding pers. comm.).

***Acrodipsas cuprea variabilis* subsp. n.**

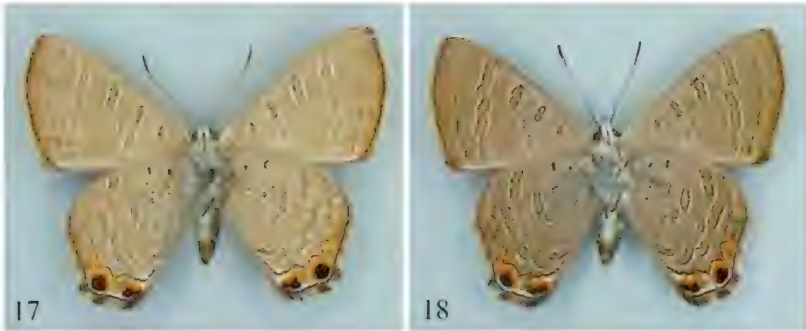
(Figs 9-18, 46-48)

Acrodipsas cuprea (Sands) 'brown and blue forms': Braby 2000, Field 2013, Eastwood and Hughes 2003a.

Types. *Holotype* ♂, labelled 'QUEENSLAND, Mt Ngungun, 253 m, Glasshouse Mtns Nat Pk, 26°53'59"S, 152°56'06"E, 11 March 2005, M.C. Sands', 'Reg. No. T232286', in QM. *Paratypes:* QUEENSLAND: 1 ♀, Mt Tibberooowuccum, 232 m, 26°53'59"S, 152°56'06"E, 23 March 2003, M.C. Sands, Reg. No. T232287, in QM; 2 ♂♂, Mt Tibberooowuccum, 232 m, 26°55'S, 152°55'58"E, 26 January 2003, M.C. Sands, Reg. Nos. T232167 & T232168, in QM; 1 ♂, Mt Tibberooowuccum, 232 m, 26°55'S, 152°55'58"E, 23 February 2003, M.C. Sands; 1 ♀, same data except 2 March 2003, in AMS; 1 ♂, 1 ♀, Mt Tibberooowuccum, 232 m, 26°55'S, 152°55'58"E, 15 February 2003, M.C. Sands, in NMV; 1 ♂, Mt Maroon, 882 m, 28°12'2"S, 152°43'52"E, 15 December 2002, M.C. Sands; 1 ♂, 1 ♀, same data except 22 December 2002; 1 ♀, same data except 16 March 2003; 2 ♂♂, Bunya Mountains, 735 m, 4.8 km Nth Burtons Well, 26°47'58"S, 151°34'11"E, 9 February 2006, M.C. Sands; 1 ♂, Coochin Hills (west peak), 240 m, 26°47'58"S, 151°34'11"E, 03 September 2006, M.C. Sands; 1 ♂, Mt Tibberooowuccum, 232 m, 26°55'S, 152°55'58"E, 26 January 2003, M.C. Sands; 1 ♂, same data except 3 May 2003; 1 ♂, same data except 1 April 2006;



Figs 9-16. *Acrodipsas cuprea variabilis* subsp. n.: (9, 11, 13, 15) ♂♂ uppersides; (10, 12) ♀♀ uppersides; (14, 16) ♀♀ undersides. Localities: (9-10, 12-14, 16) Glasshouse Mountains, Qld; (11, 15) Toowoomba, Qld.



Figs 17-18. *Acrodipsas cuprea variabilis* subsp. n.: ♂♂ undersides, Glasshouse Mountains, Qld.

1 ♀, same data except 20 September 2003; 1 ♂, Mt Tibrogargan, 264 m, 26°55'37"S, 152°56'60"E, 3 January 2003, M.C. Sands; 1 ♂, North Stradbroke Island, Tripod Lookout, 27°26'24"S, 153°27'52"E, 20 September 2006, M.C. Sands; 1 ♂, Flinders Peak, 679 m, 27°48'47"S, 152°45'36"E, 1 December 2002, M.C. Sands; 1 ♂, Rocky Knob via Toowoomba, 580 m, 27°36'50"S, 152°02'14"E, 29 December 2004, M.C. Sands; 1 ♂, same data except 28 May 2009; 1 ♀, same data except 10 March 2005, all in MCS; 26 ♂♂, 9 ♀♀, Toowoomba, J Macqueen, dated 29-10-64 (1♂), 27-10-65 (1♂), 15 Nov 65 (1♂), 15-12-65 (1♂), 18-12-65 (1♂), 21-12-65 (2♂♂), 14-1-66 (1♂), 9-2-66 (1♂), 22-2-66 (2♀♀), 2-3-66 (1♂), 12-10-66 (1♂), 13-10-66 (1♀), 27-10-66 (1♀), 28-10-66 (2♂♂), 10 Nov 66 (1♂), 10-11-66 (1♂), 15-11-66 (1♂), 17-11-66 (1♂), 6 Feb 67 (1♂), 4-3-67 (1♂), 31-1-67 (2♀♀), 20-2-67 (1♀), 25-2-67 (1♀), 10 Oct 68 (2♂♂), 11-12-68 (1♂), 9 March 71 (3♂♂), 21-3-71 (1♂, 1♀); 1 ♀, Toowoomba, 2 Oct 66, D. Sands; 1 ♀, Mt Tinbeerwah, Noosa, 6 Sept. 82, R. Eastwood, all in ANIC; 1 ♂, Mt Cooroora, Pomona, 10 March, 2015, R Mayo; 1 ♂, Mt Cooroora, Pomona, 21 September, 2003, R Mayo; 1 ♂, Mt Tinbeerwah, Tewantin, 10 September, 2003, R Mayo; 1 ♀, Mt Tinbeerwah, Tewantin, 10 April 2003, R Mayo; 1 ♀, Mt Tinbeerwah, Tewantin, 24 August 2004, R Mayo; 1 ♂, Blackdown Tableland, 17 September 2006, R Mayo; all in RM. NEW SOUTH WALES: 1 ♂, Grafton, 10 Nov 1944; 1 ♂, Slaughterhouse Pinnacle, 29°44'S, 150°18'E, 28 xii 1994, H. (Mike) Groth, in ANIC.

Description. *Male* (Figs 9, 11, 13, 15, 17, 18). Antenna length (of holotype) 7.3 mm; shaft black with segmental bands white; club long, dorsally and ventrally dark brown-black, apex tipped with orange; head dorsally black, ventrally overlain with long white hairs scales; frons grey-black with narrow median white line and white line narrowly above eyes; eyes grey-black; palpi dorsally dark grey-brown, ventrally with patches of white scales, apex tipped white; thorax and abdomen dorsally grey-black, edged with long brown scales extending over wing bases, ventrally overlain with white hair scales; legs brown with fore and hind femora not swollen, tarsi brown, femur and tibia with long white hair scales, apical fore-tibial spines (modified setae) moderately developed, thickened basally, longer than spurs on tarsi. Forewing length (of holotype) 14.2 mm, costa and inner margin almost straight, apex

strongly acute, termen weakly bowed M_1 - CuA_1 , tornus obtuse; upperside dark brown, medium grey-brown or coppery brown, veins often dark brown, termen darker brown, submedian and postmedian areas occasionally with indistinct coppery areas reaching inner margin, often with some basal blue scales, cilia light brown. Hindwing costa almost straight, termen bowed, between M_1 and CuA_1 , squared CuA_1 to $1A+2A$ at tornus, inner margin straight; upperside grey-brown, darker towards base, often with some basal blue scales (rarely on coastal specimens), veins and termen darker brown, transverse apical cell bar on vein M_1 to M_3 , dark brown; termen narrowly dark grey-brown; an oval black spot at termen between CuA_1 and CuA_2 , two smaller spots between CuA_2 and $1A+2A$, a narrow blue subterminal line M_3 to CuA_1 to tornus, extending broader CuA_1 to tornus separating black spots and dark termen; cilia light brown, black and broadly tufted at CuA_1 , CuA_2 and at tornus, inner marginal fold light grey. Forewing underside, pale brown-grey with pale bands rarely indistinct, edged with dark brown then white, three transverse brown bands in cell, one narrow at base, broader and dark at mid cell, broadest between bases of M_1 , M_2 and M_3 ; termen dark brown with subterminal subcrescentic line closer to tornus than termen, separated at veins R_1 to $1A+2A$, a subparallel postmedian band R_1 to M_3 , closer to termen at tornus, a submedian spot between CuA_1 and CuA_2 and band below cell beneath CuA_2 . Hindwing underside, grey-brown with brown bands edged darker brown then white; termen dark brown, narrow at apex, broader at tornus, with subterminal crenulated pale brown line, parallel to termen except closer R_s to M_1 , a median band between R_s and M_1 , a postmedian band M_1 to tornus, displaced between veins with sections M_1 to M_3 and CuA_1 to CuA_2 closer to termen, section between $1A+2A$ and inner margin closer to $3A$; a prominent subterminal black spot between CuA_1 and CuA_2 ; two black spots, sometimes merged, between CuA_2 and $1A+2A$, both edged anteriorly and prominently with orange, spots separated from dark termen by narrow white line CuA_2 to tornus.

Male genitalia (Figs 46-48). Unmounted: vinculum + tegumen subcircular, slightly longer than wide in posterior view. Slide mounted: margins of socius strongly bowed, sociuncus lobe broad, uncus bifurcate, branches well separated at base; brachium long, slender, apical section *ca* twice as long as basal section; valva with base broadly oval, concave near midpoint, apical section subequal in length to basal section, apically narrower than at median fold, apex subsquared, tip pointed, outwardly directed, fold slender, weakly sclerotised; juxta U-shaped with relatively long apical arms; aedeagus basally broad, prezonal sheath rounded anteroventrally, zone narrow, postzonal sheath *ca* two-thirds length of prezonal sheath, curved ventrally near midpoint, slender, smooth, apically tapered to a point.

Female (Figs 10, 12, 14, 16). Antenna length (of allotype) 6.5 mm; head, palpi, thorax, abdomen and legs similar to male, palpi with second segment longer than male, abdomen considerably larger than male abdomen, ventral

surface of thorax, anterior surface of abdomen, femur and tibia with long white hair scales. Forewing apex obtuse, termen strongly bowed, tornus obtuse, uppersides of both wings brown-black with basal and submedian areas of medium to dark blue; forewing basal 1/2-2/3 blue, mostly filling cell, extending to mid inner margin or slightly beyond posteriorly; apical cell vein at bases of M_1 and M_2 dark brown-black; cilia white. Hindwing costa bowed, grey-brown, termen straight between M_1 and CuA_1 , produced and squared between CuA_1 to CuA_2 , slightly concave between CuA_2 and $1A+2A$; above blue area from base to cell postmedian region, extending from cell to beyond inner margin, with transverse black cell bar between bases of M_1 and M_2 , occasionally a series of subterminal crenulated blue markings from M_1 to $1A+2A$, a large subtriangular black spot between CuA_1 and CuA_2 , a narrow black spot or band between CuA_2 and $1A+2A$, a narrow blue subterminal line M_1 to $1A+2A$ edging black spots termen at tornus; cilia white, black and broadly tufted at CuA_1 , CuA_2 and tornus, basal half of inner marginal fold grey-brown, grading to dark brown towards tornus. Forewing underside, light brown with brown bands or spots narrowly edged with dark brown, then white; cell with transverse bands dark, narrow at base and at mid cell, a spot between subbases of CuA_1 and CuA_2 , a subbasal band between CuA_2 and $1A+2A$, a broad postmedian band, slightly displaced at M_1 , closer to termen at tornus than apex, a narrow subterminal band, dark brown, somewhat crenulated, slightly closer to termen at tornus than apex; area between subterminal band and termen slightly darker brown, darker and narrower towards termen. Hindwing underside with basal and submedian narrow bands or dark spots, two at base of cell; mid and postmedian bands wider, sections M_1 to M_3 at cell apex and CuA_1 to CuA_2 closer to termen, section between CuA_2 and $1A+2A$ angled anteriorly towards base; two black spots separated at tornus, edged orange anteriorly, one a larger, oval spot between CuA_1 and CuA_2 , the second a smaller spot at tornus overlying $1A+2A$; spots at termen edged narrowly blue CuA_2 to tornus; a dark postmedian band, angled and closer to base at inner margin; inner half of marginal fold light grey; cilia light brown-cream, black and broadly tufted at CuA_1 , CuA_2 and tornus.

Female genitalia. Slide mounted: apophyses anteriores slender, apically tapered, moderate in length; papillae anales broadly rounded, finely setose; ostium bursae small, U-shaped, weakly sclerotised, surrounded by broad U-shaped anterior wall of ostium; ductus bursae not sclerotised, membranous, broad, long, gradually expanded to merge with anteriorly rounded, membranous corpus bursae.

Comments. Males of *A. c. variabilis* are readily distinguishable from the nominotypical subspecies by absence or obscurity of the subtriangular coppery basal area on the upperside of the forewings. The ground colour of males of *A. c. variabilis* is usually much darker than that of *A. violacea*, but may vary from dark brown to coppery brown with occasional blue basal scales on both wings, mostly on specimens from the main Dividing Range.

The ground colour is similar to that of the upperside of *A. brisbanensis* (Miskin) but in *A. c. variabilis* the termen of males, although variable in shape, is more strongly bowed than in either *A. brisbanensis* or *A. c. cuprea*. The ground colour of females and areas of blue of *A. c. variabilis* are very similar to the nominotypical subspecies, but in *A. c. variabilis* the termen of the forewing in females is more strongly bowed than in either *A. c. cuprea* or *A. violacea*.

Male and female genitalia are similar to those of nominotypical *A. c. cuprea* (see Sands 1997). The apices of the valvae of males of *A. c. variabilis* appear to be slightly longer than in *A. c. cuprea* but not as slender as in *A. violacea*.

Variation. The forewings of small males of *A. c. variabilis* are often more strongly bowed than in larger specimens, accompanied by extraordinary variation in wingspans (♂♂ 16-24 mm, ♀♀ 17-28 mm), usually in specimens from the Glasshouse Mountains, where small males are unusually abundant.

The upperside of males of *A. c. variabilis* from Stradbroke Island is darker grey-brown than in specimens from the mainland and is not known to have areas of blue, whereas specimens from the Glasshouse Mountains and other mainland coastal areas occasionally have areas of blue on both wings. Blue basal scales are uncommonly seen on coastal specimens of males of *A. c. variabilis*. The ground colour of males from Toowoomba is sometimes light brown with basal coppery suffusions; this variation is also seen in specimens from other parts of the main Divide and from Blackdown Tableland. The upperside of males from the main Divide from Amiens and between Toowoomba and Blackdown Tableland (8%, n = 61) sometimes has blue scales, which rarely fill the cell of the forewing and do not extend to the postmedian region of the hindwing.

In males of *A. c. variabilis* the apical fore-tibial spines are more strongly developed than in *A. violacea*, but appear to vary according to the size of the specimen, with longer and basally broader spines on larger specimens.

The ground colour of females of *A. c. variabilis* is darker than that of *A. violacea* and the extent of blue on the uppersides of both wings is less extensive than the violet-blue areas of females of *A. violacea*.

Distribution. New South Wales: Grafton (Ramornie Trig) and northwards on the main Dividing Range to the NSW Border and west to Slaughterhouse Pinnacle; Queensland: coastal hills and southern ranges, including North Stradbroke Island, Mount Maroon, Flinders Peak, Glasshouse Mountains (including Mts Tibberooowuccum, Tibrogargan and Ngungun), Wild Horse Mountain, Coolum, Mt Tinbeerwah, Mt Cooroora, Pomona, Rainbow Beach, Main Dividing Range including Amiens, Mt Ferguson, Toowoomba, Kroombit Tops, Mt Moffatt, Carnarvon National Park (Monteith and Yeates 1986, 1988) and the Blackdown Tableland.

Biology. Unknown. Freshly emerged males have been observed resting on stumps (ca 1 m) infested with an ant, *Crematogaster* sp. (R. Mayo, pers. comm.). Females emerge with ovaries mature.

***Acrodipsas violacea* sp. n.**

(Figs 19, 20-35, 43-45, 49-51)

Acrodipsas cuprea (Sands) 'brown and blue forms': Braby 2000, Eastwood and Hughes 2003a.

Types. *Holotype* ♂, labelled 'QUEENSLAND, Commodore Peak via Millmerran, 609 m, 27°56'15"S, 151°13'17"E, 17 September 2004, M.C. Sands', 'Reg. No. T232282', in QM. *Paratypes*: QUEENSLAND: 1 ♂, Commodore Peak, via Millmerran, 609 m, 27°56'15"S, 151°13'17"E, 27 September 2004, M.C. Sands, genitalia slide DPAS 77, Reg. No. T232284; 1 ♂, same data except without slide and 26 April 2005, Reg. No. T232283; 1 ♀, same data except 25 October 2004, MC & DPA Sands, genitalia slide DPAS78, Reg. No. T232285; 2 ♂♂, Dunmore via Dalby, SW of Cecil Plains, 9 Dec. 1984, M. De Baar, 224 M, Reg. Nos. T232169 & T232173; 2 ♂♂, Dunmore via Dalby, 11 Dec. 1987, M. De Baar, Reg. Nos. T232170 & T232171; 1 ♂, same data except 22 Dec. 1981, *A. cuprea* det D.P. Sands, Reg. No. T232172, all in QM; 1 ♂, Commodore Peak, via Millmerran, 609 m, 27°56'15"S, 151°13'17"E, 17 September 2004, M.C. Sands; 1 ♂, 1 ♀, same data except 19 September 2005; 1 ♂, same data except 31 October 2009; 1 ♂ same data except 24 September 2005; 2 ♂♂, Dunmore via Dalby, 9 Dec. 1984, M. De Baar; 1 ♀, Millmerran, 28 Mar. 1941, J. Macqueen; all in ANIC; 1♂, Dunmore Forest, 402 m, 16 km S.W. Cecil Plains, 27°37'30"S, 151°01'09"E, 31 October 2009, M.C. Sands; 2 ♂♂, Commodore Peak, via Millmerran, 609 m, 27°56'15"S, 151°13'17"E, 17 September 2004, M.C. Sands; 2 ♂♂, same data except 19 September 2005; 6 ♂♂, same data except 24 September 2005; 6 ♂♂, same data except 27 September 2004; 1 ♂ same data except 28 September 2004; 1 ♂ same data except 4 October 2008; 1 ♂, same data except 23 October 2004; 1 ♂, same data except 24 January 2006; 2 ♂♂, same data except 26 April 2005; 2 ♂♂, same data except 9 October 2004, M.C. & D.P.A. Sands, all in MCS.

Descriptions. The descriptions of adults and adult variation are based on specimens either unaffected by grease, or after grease has been removed by immersion of mounted specimens in ethyl acetate.

Male (Figs 20, 22, 24, 26, 28, 30, 32, 34). Antenna length (of holotype) 6.5 mm; shaft black with segmental bands white; club long, dorsally and ventrally brown-black, apex faintly tipped with orange; head dorsally black, ventrally overlain with long white hairs scales; frons black with narrow median white line and white line narrowly above eyes; eyes grey-black; palpi dorsally dark grey-brown, ventrally with patches of white scales, apex tipped white; thorax and abdomen dorsally grey-black, edged with long pale brown scales extending over wing bases, dorsally grey-black, ventrally overlain with white hair scales; legs (Figs 19, 51) brown with fore and hind femora not swollen, tarsi lighter brown, apical fore-tibial spines weakly developed, not thickened basally, not longer than spines on tarsi, femur and tibia with long

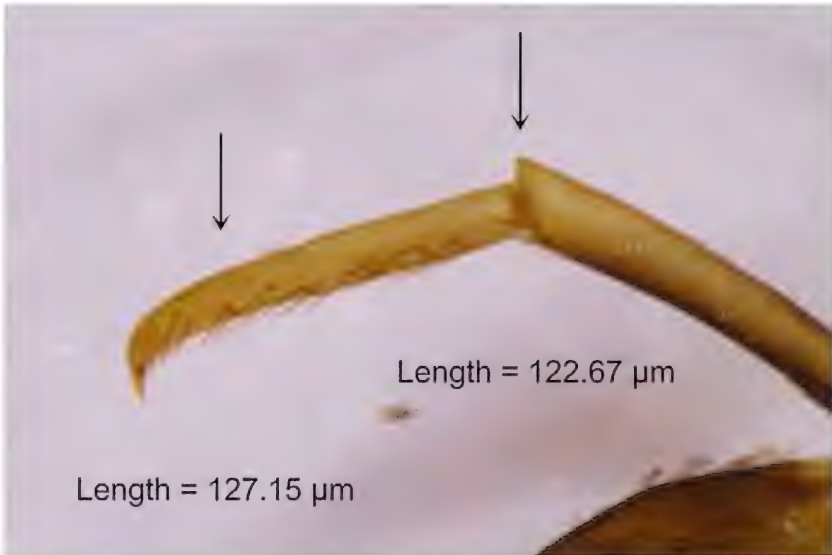
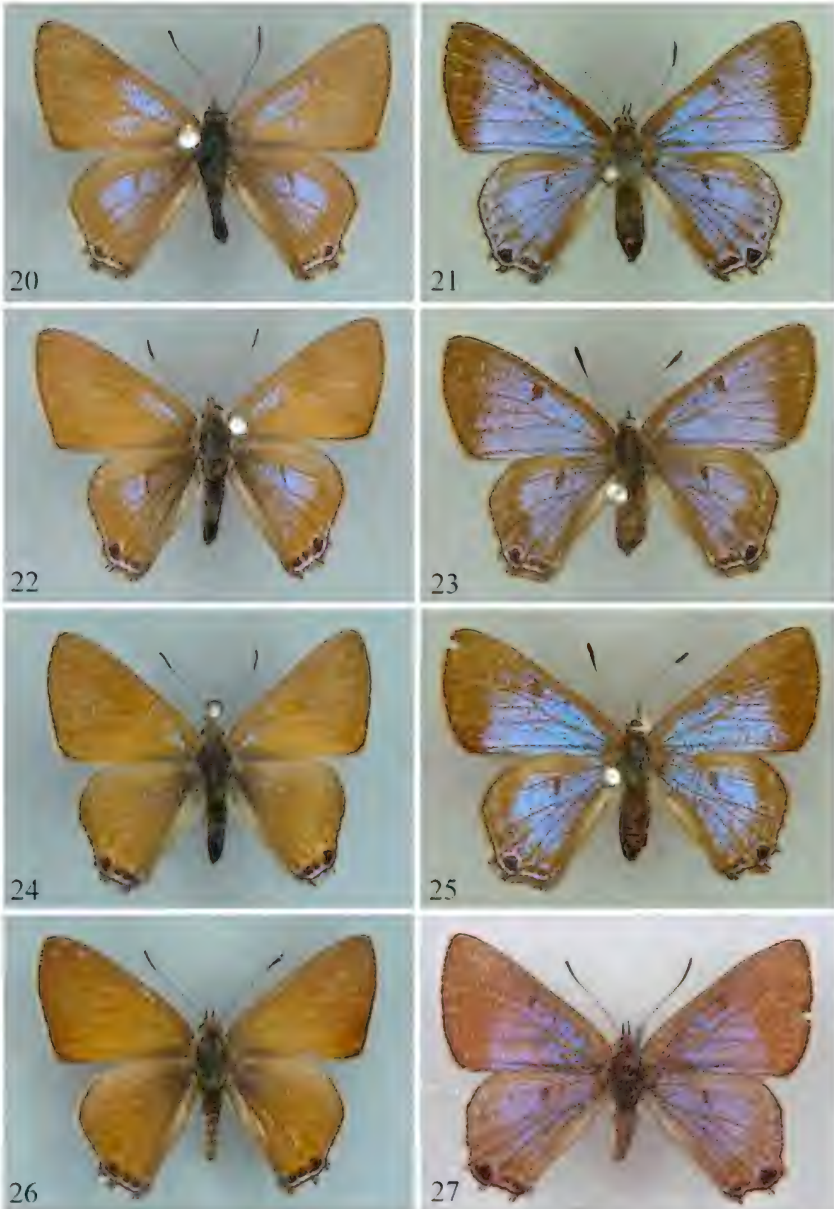
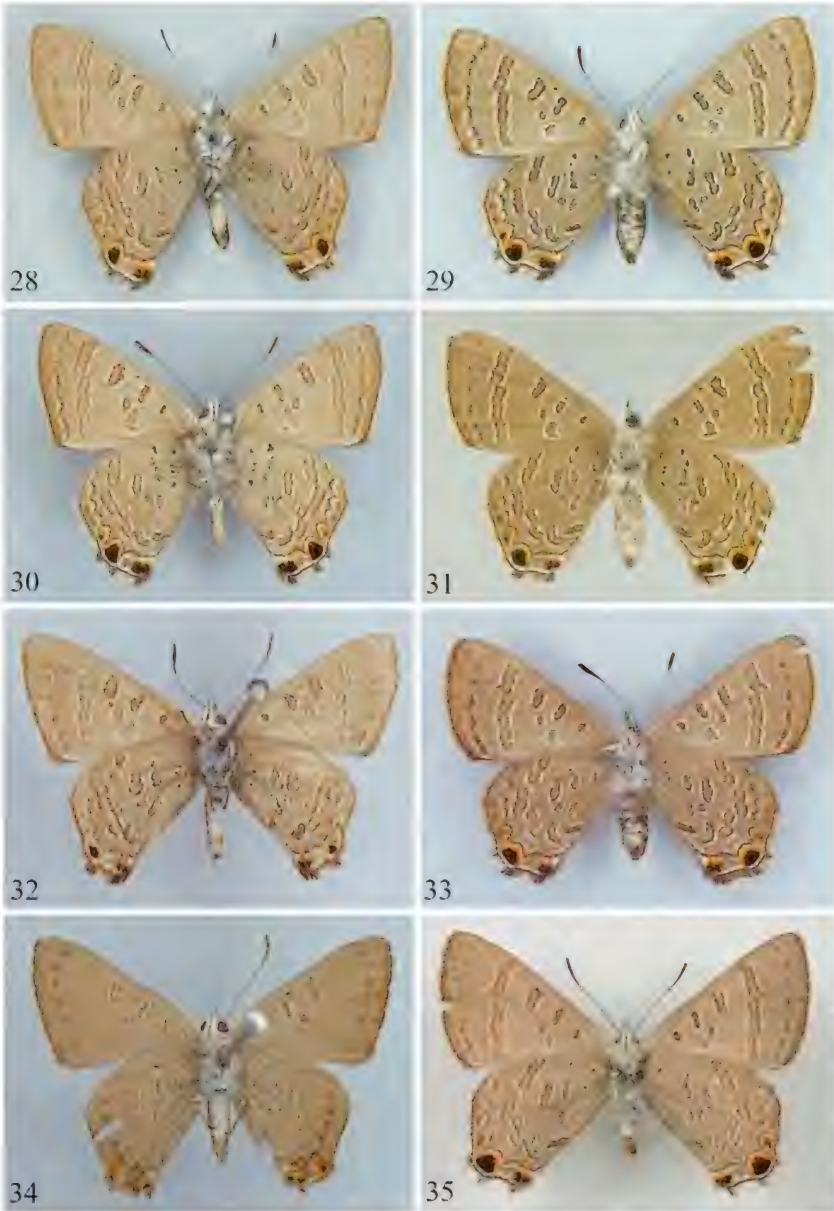


Fig. 19. *Acrodipsas violacea* sp. n.: male fore-tarsus and tibia and length of spines.

white hair scales. Forewing length (of holotype) 13.7 mm, costa and inner margin almost straight, apex acute, termen weakly bowed M_1 - CuA_1 , tornus obtuse; forewing upperside, basal half pale coppery brown extending to inner margin, grading to brown at subtermen, cell with variable scattered or dense blue-violet scales, extending below cell to base of CuA_2 ; subcostal vein and postcellular veins brown; termen narrowly dark grey-brown, broader at tornus; cilia cream. Hindwing costa weakly bowed, termen straight, angled at M_1 , straight between M_1 and CuA_1 , squared CuA_1 to $1A+2A$ at tornus, inner margin straight; upperside pale coppery brown, with variable areas of blue-violet in cell and most broadly in postmedian region M_1 to CuA_2 , a transverse apical cell bar dark grey, darkest between M_1 and M_2 , veins brown; termen narrowly brown-black, an oval black spot at termen between CuA_1 and CuA_2 , two small spots between CuA_2 and $1A+2A$, a narrow blue subterminal line separating black spots and termen, CuA_1 to tornus; cilia cream, black and broadly tufted at CuA_1 , CuA_2 and tornus, inner marginal fold grey-brown. Forewing underside, pale brown-grey with pale bars or bands, edged darker brown then white, often indistinct except subterminal dark line, three transverse dark brown bars in cell, one narrow and darkest at base, broader and dark at mid cell, broadest and pale between base of M_1 , M_2 and M_3 ; termen dark brown with subterminal brown line, closer to tornus than apex, not edged with white and interrupted at veins R_1 to $1A+2A$, a subparallel postmedian band R_1 to M_3 , pale or indistinct towards inner margin or absent between M_3 and CuA_2 , two submedian spots, one between CuA_1 and CuA_2 and one below cell beneath CuA_2 .



Figs 20-27. *Acrodipsas violacea* sp. n. uppersides: (20, 22, 24, 26) ♂♂; (21, 23, 25, 27) ♀♀. Localities: (20-25) Commodore Mountain, Qld; (26) Dunmore via Cecil Plains, Qld; (27) Millmerran, Qld.



Figs 28-35. *Acrodipsas violacea* sp. n. undersides: (28, 30, 32, 34) ♂♂; (29, 31, 33, 35) ♀♀. Localities: (28-29, 31-34) Commodore Range, Qld; (30) Dunmore via Cecil Plains, Qld; (35) Millmerran, Qld.

Hindwing pale brown with brown bands edged darker brown then white, often indistinct or absent from basal half of wing; termen dark brown with subterminal brown crenulated line, parallel to termen, except closer between R_s and M_1 , a subparallel postmedian band costa to inner margin, sometimes indistinct or absent, displaced at veins with sections M_1 to M_3 and CuA_1 to CuA_2 closer to termen, section between $1A+2A$ and inner margin closer to $3A$; a prominent subterminal black spot between CuA_1 and CuA_2 ; a black band or two merging spots CuA_2 and $1A+2A$, edged anteriorly and faintly with cream-orange; black spots and subtornal black band separated from dark termen by narrow bluish white line from CuA_2 to tornus.

Male genitalia (Figs 43-45, 49). Unmounted: vinculum + tegumen subcircular, slightly longer than wide in posterior view, saccus expanded. Slide mounted: margins of socius strongly bowed, sociuncus lobe broad, uncus bifurcate, branches tapered, well separated at base, curved apically; brachium long, slender, apical section *ca* twice as long as basal section, apical point outwardly directed; valva with base broadly oval, concave before midpoint, apical section longer than basal section, tapered, narrowing at midpoint, subapical fold semicircular, weakly sclerotised $2/3$ distance from base, apex squared, tip outwardly directed; juxta with arms relatively long, apically curved inwardly, outwardly turned at base; aedeagus basally broad, prezonal sheath *ca* two-thirds length of prezonal sheath, postzonal sheath concave near midpoint (viewed laterally), curved ventrally, apically tapered to a strongly sclerotised apex.

Female (Figs 21, 23, 25, 27, 29, 31, 33, 35). Antenna length (of allotype) 6.4 mm; colour of head, palpi, thorax, abdomen and legs similar to male, palpi with second segment longer than male, abdomen relatively large; ventral surface of thorax, anterior surface of abdomen, femur and tibia with long white hair scales. Forewing length (of allotype) 13.4 mm, apex obtuse, termen bowed, tornus obtuse; upperside broadly violet-blue from base to postmedian region and inner margin, sometimes extending between subtermen and termen, a prominent brown-black bar at apex of cell between M_1 and M_2 ; subtermen broadly brown from costa to tonus, broader at apex than tornus, termen narrowly dark brown, cilia cream-brown. Hindwing costa bowed, mostly at apex, termen straight between M_1 and CuA_1 , produced and squared between CuA_1 to CuA_2 , slightly concave between CuA_2 and $1A+2A$; upperside broadly violet-blue from base to postmedian region, broadest at $1A+2A$, apex of cell with prominent brown-black bar between bases of M_1 and M_2 , subtermen broadly brown costa to tornus, a series of subterminal crenulated violet-blue markings enclosing dark brown from R_s to $1A+2A$ at subtornus; termen narrowly brown-black, a large subtriangular black spot between CuA_1 and CuA_2 , a black band between CuA_2 and $1A+2A$, a narrow blue subterminal line M_1 to $1A+2A$ edging black spots at tornus; cilia cream-brown, black and broadly tufted at CuA_1 , CuA_2 , broadest at tornus, inner marginal fold pale grey-brown, grading to darker brown towards tornus.

Forewing underside, pale grey-brown with brown bands or spots narrowly edged with dark brown, then white; cell bands darkest and merged at base, narrow and dark at mid cell, paler at cell apex, a spot between subbases of M_1 and CuA_1 and CuA_1 and CuA_2 , postmedian band broad, closer to termen at tornus than apex, section between R_3 and R_{4+5} and M_3 to CuA_2 displaced towards base, subterminal band narrow, somewhat crenulated, slightly closer to termen at tornus than apex, area between subterminal band and termen brown with ground colour darker and narrower towards termen; hindwing underside basal and submedian bands narrower than postmedian band, cell basal, mid and apical bands progressively wider, postmedian band broad, sections M_1 to M_3 at cell apex and CuA_1 to CuA_2 closer to termen, section between CuA_2 and $1A+2A$ angled anteriorly towards base, two prominent subterminal black spots separated at tornus, edged orange anteriorly, one larger oval spot between CuA_1 and CuA_2 , a second smaller spot at tornus overlying $1A+2A$, spots edged narrowly blue, a dark postmedian band.

Female genitalia (Fig. 50). Slide mounted: apophyses anteriores slender, apically tapered, moderate in length; papillae anales broadly oval, finely setose; ostium bursae small, moderately sclerotised, shallowly U-shaped with out-turned arms, surrounded by U-shaped anterior wall of ostium, wider than long; ductus bursae not sclerotised, membranous, broad, gradually expanded to merge with small, anteriorly rounded, membranous corpus bursae.

Comments. The ground colour on the upperside of males of *A. violacea* is coppery brown, rather than the brown or dark grey-brown usual for *A. cuprea variabilis*. Violet-blue basal areas are mostly present in males of *A. violacea*, except for some specimens from the Dunmore area, where the upperside is uniformly pale coppery brown. The forewing termen of *A. violacea* is less bowed than that of *A. c. variabilis*, somewhat resembling the termen of *A. brisbanensis*. On the hindwing underside, the orange edging of the black spots near the tornus of *A. violacea* is paler than the orange of *A. c. variabilis* and in some specimens of *A. violacea* the orange edging is replaced by cream. The underside bands in males of *A. violacea* may be clearly marked, obscure or absent and the narrow subterminal brown band, interrupted by veins, may be the only postmedian marking on the forewing. In male *A. violacea* when bands are present on the underside, the white edging tends to be more clearly marked than in the bands of *A. c. variabilis*. On the legs of males, the apical fore-tibial spines are less developed when compared with *A. cuprea variabilis* and, although not longer than spines on the tarsi, appear to vary according to the size of the specimen, with more robust tibial spines occurring on larger specimens. The male genitalia are similar to those of *A. cuprea* and *A. aurata* (Sands 1997), but the apices of valvae of *A. violacea* are narrower than those of *A. c. variabilis* and resemble somewhat the shapes of valvae of *A. mortoni* Sands, Miller & Kerr (see Sands *et al.* 1997, fig. 12).

In *A. violacea* females, the violet-blue areas extend to the postmedian region or beyond and to the inner margin of both wings, whereas in females of *A. cuprea variabilis* the blue areas rarely extend beyond the cell. The ground colour of females of *A. violacea* from Millmerran and Commodore Peak is light to medium brown, with distinctive violet-blue areas extending beyond the cells of the upperside of both wings and reaching the postmedian region and subternus, whereas in *A. cuprea variabilis* the ground colour is grey-black and the dark blue area is restricted to the basal half of the forewings. To date, no females of *A. violacea* are known from Dunmore for comparison with the females from Millmerran and Commodore Peak, which have extensive areas of violet-blue on both wings. Based on one specimen available for dissection, the female genitalia (Fig. 50) could not be distinguished from those of *A. cuprea*.

Variation. The upperside of males of *A. violacea* varies in the shade of the brown ground colour, the basal coppery areas on the forewings and subternus of hindwings, the extent of blue scales and the prominence of cell and postmedian veins. Blue areas on the upperside of both wings are present on males of *A. violacea* from Commodore Peak, but are less extensive or absent on the few males known from Dunmore. The shade of light brown on the upperside varies and the underside of males is very variable, with median bands on the underside often indistinct or absent and, except for the prominent brown subterminal line, interrupted at the veins of both wings. Orange edging to the black spots near the tornus of *A. violacea* may be pale and in some specimens orange is replaced by cream. The violet-blue areas on the upperside of females of *A. violacea* are variable in extent but are much more extensive on both wings than the areas of blue of *A. cuprea variabilis*.

Distribution. To date, *A. violacea* has been recorded at Millmerran, Commodore Range and Dunmore, via Cecil Plains, and observed at Captains Mountain. Several males from Mount Moffatt may be this species but the absence of females from this locality prevents confident identification or designation of these as paratypes of *A. violacea*. Males of *A. cuprea variabilis* have been found at some inland localities where *A. violacea* and *A. cuprea* may prove to be sympatric when more material, particularly females, becomes available.

Biology. The habitats of this species are *Eucalyptus* and *Allocasuarina* woodlands on isolated inland ridges of southern Queensland, where males congregate to intercept unmated females that visit hilltops. Males of *A. violacea* are rapid in flight, resembling the behaviour of *A. brisbanensis* rather than that of *A. cuprea variabilis*. A female of *A. violacea* was collected from blossom by J. Macqueen on his property about 24 km south of Millmerran and females were observed (M.C. Sands) flying close to a hilltop around a dead tree (ca 7 m) supporting a colony of ants.

Larvae of *A. violacea* are likely to be predatory on the immature stages of ants and, as in the case with other freshly captured female *Acrodipsas* spp., the expanded abdomens of freshly emerged females contain many fully developed eggs.

***Acrodipsas aurata* Sands**

(Figs 36-42)

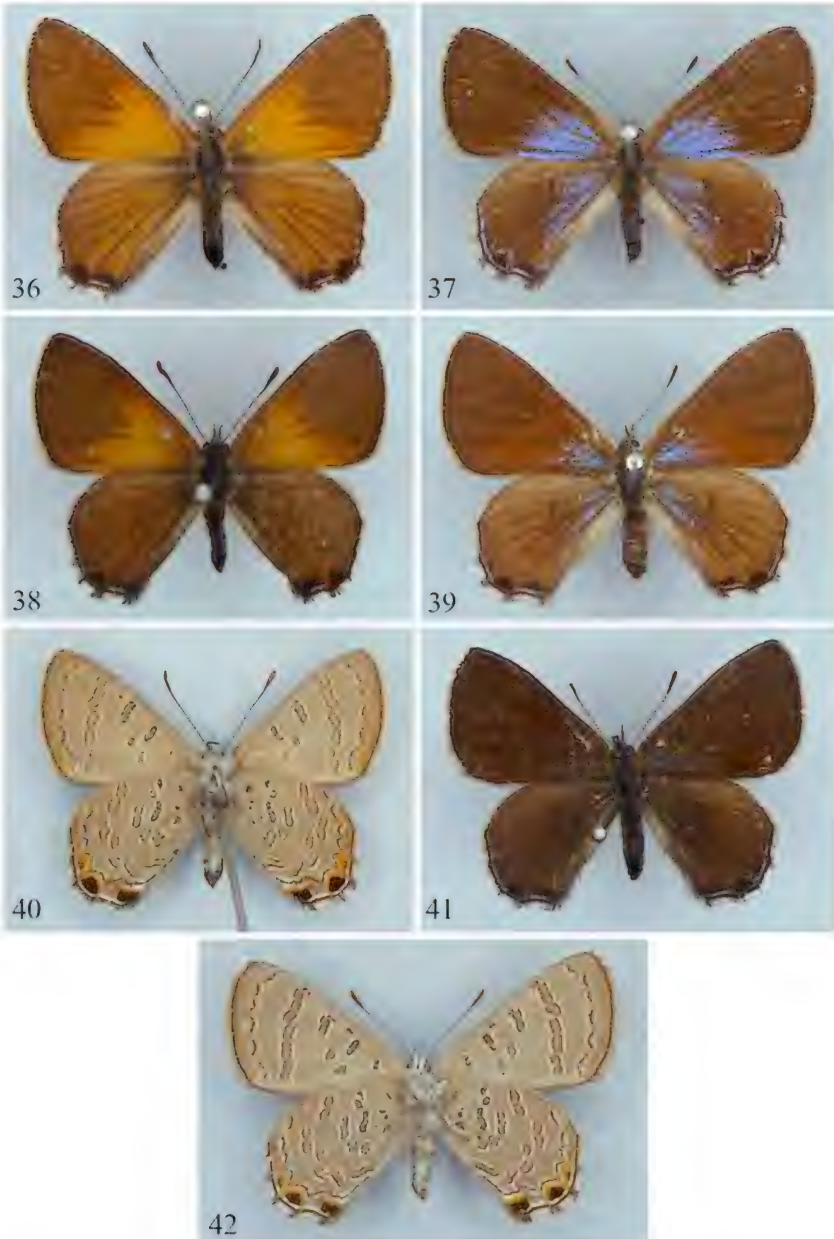
Acrodipsas aurata Sands, 1997: 339-344. Holotype ♂, Mount Ainslie, Australian Capital Territory, in ANIC Canberra.

Diagnosis. Sands (1979) noted distinctive features in the apices of valvae of male genitalia of specimens thought at that time to be a form of *Acrodipsas cuprea* from coastal and montane NSW. Subsequently, differences in wing patterns of both sexes, wingspan and shape of both wings, and male genitalia, enabled separation of *A. aurata* from *A. cuprea*, with recognition of *A. aurata* as a distinct species (Sands 1997).

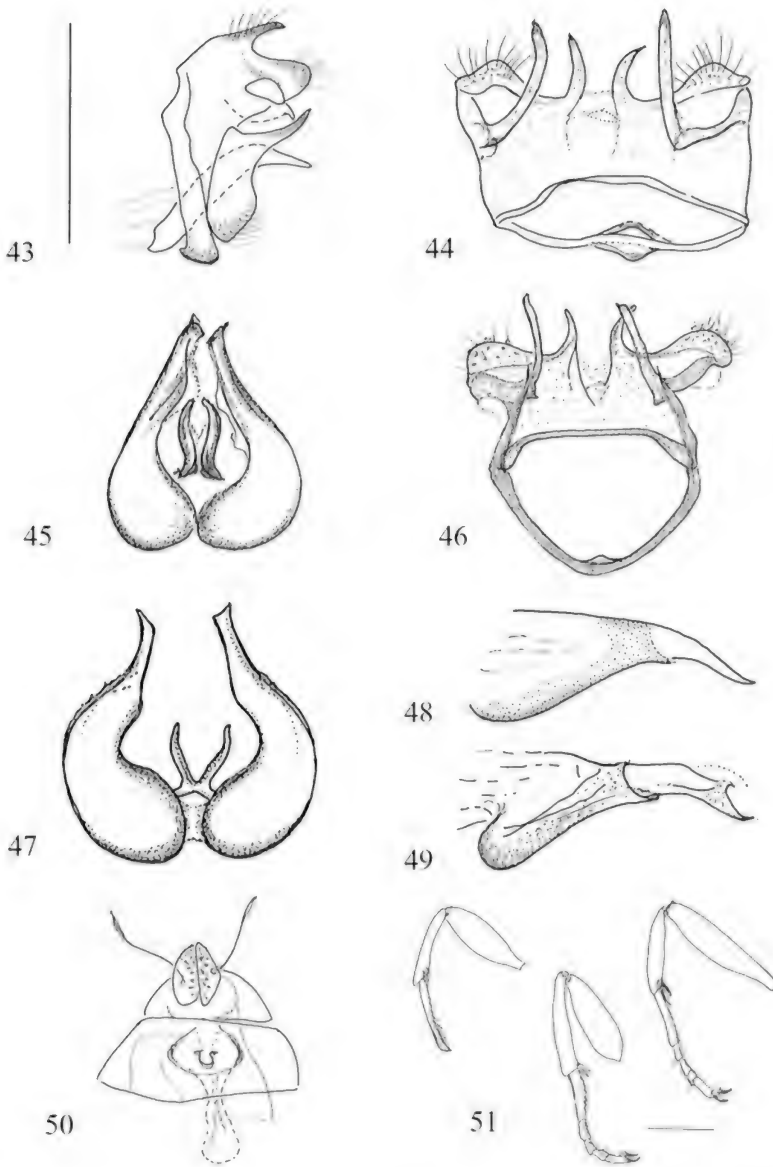
Variation. Some variation has been observed in males of *A. aurata*, mostly in the extent of the subtriangular coppery basal area of the forewing upperside, the prominence of dark postcellular veins and the presence of the coppery suffusions on the hindwing upperside (Braby 2000). Females from Canberra and the Southern Highlands of NSW vary considerably, with the ground colour varying from dark brown to grey-black on the upperside, sometimes with an indistinct subbasal coppery suffusion, and in the extent of basal blue scales (Dunn and Dunn 1991, Braby 2000). Females from the Blue Mountains, NSW, have more extensive blue areas on both wings, from the base to the cell or beyond, whereas in females from the ACT the blue scales are restricted to the base, obscure or sometimes absent, as in a coppery brown female from Mt Ginini, ACT (Sands 1997). In both sexes, the taxonomically important postmedian subcostal band, between veins R_2 and R_{4+5} on the underside of the forewing, is occasionally indistinct. Females from ACT exhibit seasonal variation in the extent of blue scales, with those collected in spring thought to have less blue than those collected in late summer or autumn (C. Meyer pers. comm.).

Distribution. Australian Capital Territory (> ca 580 m): including Canberra and Brindabella Range; New South Wales: Southern Highlands, including Queanbeyan, Cooma and Blue Mountains; Victoria: Pine Mountain (Field 2013). To date, *A. cuprea cuprea* and *A. aurata* have not been collected from the same hilltops despite their occurrence within several kilometres of each other in the Southern Highlands of NSW (E. Edwards pers. comm.).

Biology. An infertile female of *A. aurata* (originally thought to be *A. cuprea*), was induced to oviposit when confined with a colony of ants of the genus *Crematogaster* (Atkins 1984, Sands 1997). The larvae of *A. aurata* are likely to be predatory on immature stages of ants.



Figs 36-42. *Acrodipsas aurata* Sands: (36-39, 41) uppersides, (40, 42) undersides: (36, 38, 40) ♂♂; (37, 39, 41-42) ♀♀. Locality: Canberra, ACT.



Figs 43-51. *Acrodipsas* spp: (43-45, 48, 50-51) *Acrodipsas violacea* sp. n., (46, 47, 49) *A. cuprea variabilis* subsp. n.; (43-49) ♂ genitalia: (43) unmounted, lateral view; (44-51) slide mounted: (44, 46) sociuncus, (45, 47) valvae, (48-49) aedeagus; (50) ♀ genitalia; (51) ♂ legs. Scale bars = 1 mm.

As observed in other *Acrodipsas* species, mounted specimens, particularly males, are prone to become greasy. Females emerge with mature ovaries, as evidenced by large numbers of fully developed eggs in abdomens of freshly captured, unmated specimens. *Acrodipsas aurata* is associated with eucalypt woodlands of the ACT, Victoria and the Southern Highlands and Blue Mountains of NSW, where males congregate on hilltops and freshly emerged females visit the sites to mate.

Discussion

Our decision to recognise two subspecies of *A. cuprea* is based on the two taxa having discrete geographical distributions. Males of *A. c. variabilis* exist in several colour forms but the variation is not consistently linked to distribution; thus there is no justification for recognising other additional forms of *A. cuprea* as subspecies. However, this study does not fully resolve the identities of representatives from all populations considered to belong to subspecies *A. c. variabilis*, with insufficient females known from some localities where males have been collected, preventing a comprehensive overview of variation and distribution of *A. c. variabilis*. For example, a series of males from the Glasshouse Mountains can be divided into two groups, one with smaller wingspans and a more convex termen when compared with variation in other localities, but without other detectable morphological differences.

Recognition of *A. violacea* as a distinct species is based on the upperside coloration of males and females, the distribution, slight differences in the male genitalia and, in most male specimens, the relative lengths of spines on the tarsi and tibiae. While there is a superficial resemblance between the blue males of *A. violacea* and some males of *A. c. variabilis*, the few females of *A. violacea* available for study have more extensive areas of blue-violet than the areas of blue in females of *A. c. variabilis* and the ground colour of *A. violacea* is a considerably lighter brown. Differences between the length of fore-tibial spines on male forelegs of *A. violacea* and *A. c. variabilis* appear to be important, but the spine lengths can also vary according to size of the adult specimens. More specimens are required for detailed comparisons of slide-mounted material before this structural difference between the legs of the two species can be better understood. The decision to describe *A. violacea* as a distinct species, rather than as a subspecies of *A. cuprea*, took into account similar decisions made for separating several other closely related species of Lycaenidae. For example, Eastwood *et al.* (2008) elevated *Jalmenus eubulus* Miskin to specific rank as a species distinct from *J. evagoras* (Donovan), based on differences in the morphology, ecology and genetics of the two taxa. In so doing, the distributions of *J. eubulus* and *J. evagoras* were shown to almost overlap in some inland areas, while adults of some populations of *J. eubulus* were considered to be possibly hybridising.

We have seen a few specimens of male *Acrodipsas* from Toowoomba, Barakula State Forest and Cecil Plains that cannot be placed with certainty

with either *A. violacea* or *A. cuprea variabilis*. Other adults (in QM), collected by the late Murdoch De Baar from the Bunya Mountains, are clearly affiliated with the *cuprea*-species complex but cannot reliably be identified to species. When more material becomes available, particularly females, the two species *A. cuprea variabilis* and *A. violacea* may prove to be sympatric at some localities and hybridisation between the two cannot be ruled out.

Eastwood and Hughes (2003a, 2003b) studied the species relationships of the genus *Acrodipsas* using a base pair fragment from the 3'-end of CO1. They included a single specimen from Millmerran that did not differ in sequence from specimens from the main Divide and other inland localities, seemingly contradicting the decision to separate the new species *A. violacea* from *A. cuprea*. However, the haplotypes they derived for all specimens of *A. cuprea* differed only by a single or at most four nucleotides, indicating that this gene evolves too slowly to examine population structures and species-level relationships in the *cuprea* species-complex. To investigate this complex further, it would be advisable to examine multiple, more rapidly evolving genes, including nuclear genes. Future DNA studies on *Acrodipsas* spp. need to be combined with morphological studies and based on adequate numbers of both sexes.

Seasonal variation as seen in *A. aurata* might also occur in other species of *Acrodipsas* and, when sufficient specimens of both sexes become available, such seasonal effects on morphology will need to be considered in future taxonomic studies of this genus.

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